been put up to protect some sheep and lambs from the wind, when they noticed a fox come searching along the hedgerows. They kept perfectly still and watched, and, when he got nearer, they saw that he was collecting the sheep's wool caught on the thorns and brambles. When he had gathered a large bunch he went down to a pool at the junction of two streams, and, turning round, backed slowly brush first into the water, until he was all submerged except his nose and the bunch of wool, which he held in his mouth. He remained thus for a short time, and then let go of the wool, which floated away; then he came out, shook himself, and ran off.

Much astonished at this strange proceeding, they took a shepherd's crook, went down to the water's edge, and pulled the wool out. They found that it was full of fleas, which, to save themselves from drowning, had crept up and up the fox's brush and body and head and into the wool, and that thus the wily fox had got rid of them.

Cambridge, March 20. T. McKENNY HUGHES.

THE CIRCULATION OF AIR IN THE SOUTHERN HEMISPHERE.[1]

IN this investigation of the circulation of the atmosphere in the southern hemisphere, the author has taken a new course. Instead of proceeding in the usual way from tables of wind-direction and force, he has taken as the groundwork of his researches the atmospheric whirls themselves. He does not deal with cyclonic systems, as one might at first suppose, but with the anticyclonic, the travelling high-pressure systems. The reason of this is plainly due to his previous work, "A Discussion of Australian Meteorology" (London, 1909). After a four-year period in the variations of air-pressure over India, South Africa, and South America, and their relations to the four-year cycle in the solar variations had been successfully demonstrated, it was necessary to investigate the weather conditions in Australia with that object. In the subtropical continents of the southern hemisphere weather conditions are chiefly influenced by barometric maxima almost constantly travelling from west to east. This was first shown to be so for Australia by the astronomer H. C. Russell, of Sydney, to whom the meteorology of that continent is so much indebted.

Russell already held the opinion that these travelling barometric maxima (with the V-shaped depressions accompanying them on their south side) do not originate on the continent itself, but approach from the South Indian Ocean. In Dr. Lockyer's extensive work, above quoted, it was shown more conclusively that in the Australian area, in latitudes 20° to 40° S., anticyclonic systems travel with great velocity from west to east, and that this also holds good for South America, South Africa, and Mauritius, in the same belt of latitude. In all probability, what holds good for 130° of longitude would also obtain for the rest of the earth's circumference. A proof of this would be of great importance for the weather prediction of these southern continents. The inquiry was therefore extended over the whole southern hemisphere, in order to obtain at the same time a more secure basis for the determination of the effects of the solar variations on the circulation of the air of the southern hemisphere.

The collection of the materials for this widely extended investigation naturally gave the author much trouble and difficulty. The determination of the amplitudes of the waves of atmospheric pressure over the whole of the district in question formed the preliminary part of the work in view. The author rightly confined himself to the southern winter half-year (April to September). It is quite clear that in calculating the mean height of the pressure waves, all waves, including even the smallest, cannot be taken into account, but only those of a certain magnitude. The author finds the amplitude of the pressure wave (Schwellenwerth) for these by selecting the three greatest wave heights for each station and takes one-fifth of the mean as the lower limit. This value (Schwellenwerth) is naturally different for different places in the various latitudes.

Dr. Lockyer calculates in this way the mean heights of the waves of air-pressure for fifty-five places in the southern hemisphere, between the equator and the Antarctic continent, and enters the values in the chart. That leads further to the drawing of lines of equal wave heights of oscillations of air-pressure. The author denotes these lines by the somewhat mysteriously sounding Greek compound "Isanakatabars": lines of equal up and down movements of air-pressure. The mean amplitudes of the waves of air-pressure naturally increase from the tropics towards higher latitudes. In latitude 0° to 12° S. they reach 1 to 2 mm.; from 12° S. they increase very rapidly and attain a maximum of 18 to 19 mm. in 53° to 60° S., and then decrease again to 14 to 15 mm. in South Victoria Land. The Isanakatabar of 16 mm. occasionally fringes the Antarctic continent. The increase of the wave heights towards the south is explained by the fact that from the belt of the travelling barometric maxima, with still relatively small amplitudes, we first enter the region of V-shaped depressions which accompany them, and then, finally, that of the large cyclones of higher latitudes, the mean tracks of which may probably be taken as between 55° and 60° S. At the southern limit of these, towards the permanent Antarctic anticyclone, the amplitudes again decrease. But, generally speaking, the Isanakatabars run fairly parallel to the parallels of latitude. They exhibit, however, the peculiarity that on the mountain ranges of the west sides of South Africa and South America they trend downwards in higher latitudes, but leave the east coasts in lower latitudes. This may be ascribed to the westerly ranges of mountains in these continents.

These Isanakatabars form the starting point of further very interesting deductions by the author.

It may here be remarked that Kämtz, in his "Lehrbuch der Meteorologie" (vol. ii., p. 339), has endeavoured to draw lines of equal non-periodical oscillations of air-pressure. He calculated for numerous stations of the northern hemisphere the mean value of the *monthly variation* of air-pressure, and called his lines based thereon somewhat improperly "isobarometric" lines. It is certainly noteworthy that lines of equal barometric variation were drawn (1832) long before it was thought of constructing lines of equal air-pressure (isobars). These were first drawn by Renou (1864), and then particularly by Buchan (1869). Kämtz also remarked that his lines did not run wholly with the parallels of latitude, but that, *e.g.* the line of 8 par. lines = 18 mm., is met with on the east coast of the United States in 36° N. latitude, but in western Europe in 42°. At a much later period Fehlberg and Köppen again investigated the variations of air-pressure on a much broader basis, but also for the interval of a month (*Aus dem Archiv d. Deutschen Seewarte*, 1878, and *Meteorologische Zeitschrift*, 1883). These *monthly* barometer variations are naturally a much rougher measure of the irregular variations of pressure than the mean height of the individual pressure waves calculated by Dr. Lockyer. Köppen has already remarked that the lines of equal variations of air-pressure should be in relation with the direction of the tracks of the barometer minima.

[1] Solar Physics Committee. Southern Hemisphere Surface-air Circulation: Being a Study of the Mean Monthly Pressure Amplitudes, the Tracks of the Anticyclones and Cyclones, and the Meteorological Records of several Antarctic Expeditions. By Dr W. J. S. Lockyer, under the direction of Sir Norman Lockyer, K.C.B., F.R.S. Pp. ix+111+xv plates. (London: H.M.S.O., Wyman and Sons, Ltd. Edinburgh: Oliver and Boyd. Dublin: E. Ponsonby, Ltd., 1910.) Price 6s.

Lockyer shows that, *e.g.* the Isanakatabar of 10 mm. in Australia coincides with the average track of the barometer maxima in that continent.

The next question was: with what velocity do these pressure waves progress from west to east.

By superposing the air-pressure curves of stations of different longitudes (first in Australia) and by shifting the time scale until the crests and troughs of the waves coincide, the difference of time of their occurrence at different places is indicated at once. In this way Lockyer obtains for the continent of Australia a daily velocity of progression of the barometric maxima from west to east of 11·5° of longitude, for South Africa, 12°, for South America, 11·1°, giving a mean of about 11·5°. The velocity over the oceans is naturally much more difficult to determine; Port Durban—Perth, gives for the South Indian Ocean about 9·5° a day; Adelaide—Rikitea, for the Pacific, 9·3°. Still more uncertain is the determination for the South Atlantic, which gives about 9·2°. Over the oceans therefore the barometric waves progress with less velocity. Lockyer gives 9·2° a day as the mean value (the Antarctic Ocean comes out as 9° to 10°). So we may adopt a general mean of 10·7°, whence it would follow that anticyclones travel round the earth in about 33·6 days. The author in no wise assumes therefrom that the anticyclones remain constant in form and intensity during their progression; on the contrary, they are subject to continual changes. He estimates their length of life on the oceans to be about six to seven days.

The wind and temperature observations, also, of all Antarctic expeditions, including the most recent one by Shackleton, are discussed in detail with reference to the problems of atmospheric circulation at present in question; series of barometric minima progressing from west to east are also shown. In longitude 30° to 90° W. the paths of the barometric minima appear from these observations (*Belgica* and *Scotia*) to lie more to the south than in the easterly longitudes. This seems to show that the centre of the Antarctic anticyclone is not at the pole itself, but in easterly longitudes, far therefrom, at the farthest, perhaps, in 130° E.

A coloured frontispiece, a chart of the southern hemisphere on the polar projection, gives a good schematic representation of the barometric minima and maxima that encircle the pole, and of the warm and cold air-currents proceeding from them. In the rear of the minima the permanent Antarctic anticyclone sends cold currents to lower latitudes, while, in front of them, warm air spreads to the Antarctic regions. These formations of the warm and cold currents gear into each other like toothed wheels, while they are constantly rotating round the pole.

With reference to the apparently permanent barometric maxima over the subtropical oceans, which lie nearer to the west than to the east coast of the continents in all oceans, Lockyer develops entirely new ideas which are very interesting and worthy of further examination.

The subtropical barometric maxima lie in the belt of anticyclones constantly travelling from west to east between lat. 20° to 40°. They are not fixed forms, and form no barriers to atmospheric circulation, but indicate only the spaces where the anticyclones which are actually travelling are mostly reinforced. Over warm land-surfaces anticyclones are weakened and partially effaced; over the cool sea-surfaces they are strengthened.[1] *They therefore arrive on the west coasts of the continents with greater intensity than that with which they left the east coasts of the same.*

This very interesting view could only originate in the study of the circulation of the air over the southern hemisphere, for in the northern, the conditions are usually too complicated and disturbed by the land-surfaces.

The author deals only with the air-currents at the earth's surface. Nor does he go into the question of the nature and origin of anticyclones and cyclones, He rightly confines himself to establishing facts, which must certainly precede theories.

Dr. Lockyer's investigation, the contents of which I have briefly sketched, is a very valuable contribution to our knowledge of atmospheric circulation. Objections will probably be raised to many points, but it is pure gain to the science if occasion is given for further discussion. For the simple reason that the author does not follow the ordinary beaten tracks but presents entirely new views for examination, his work will have a very stimulating and useful effect.

J. HANN.

[1] Perhaps I may here correct a slight error which has been taken from Buchan's "Meteorology." The specific heat of water is to that of firm land not as 4 to 1, but only 2 to 1. The question here is the "volume capacity," the specific heat for equal volumes. For dry ground this is 0·5 (for damp, about 0·6), compared to water. The ratio of specific heat for equal weights is only as 0·2 to 1·0.

THE INSTITUTE OF HUMAN PALÆONTOLOGY.

ATTENTION was recently directed in NATURE (January 26, p. 412) to the establishment by the Prince of Monaco of an institute of human palæontology in Paris. The council of administration has now been appointed; it consists of his Highness the Prince as president; MM. Dislère and E. Mayer, conseillers d'état; MM. Boule and Verneau, professors of palæontology and anthropology in the Muséum d'histoire naturelle in Paris; M. Salomon Reinach, member of the Institut and Conservateur of the Musée des antiquités nationales; and M. Louis Mayer, conseiller intime of the Prince. On account of his great services to archæology and his administrative experience, Prof. M. Boule will be the director of the institute. Two collaborators have been appointed: l'Abbé H. Breuil, professor of prehistory and ethnography of the University of Fribourg, who will occupy the chair of prehistoric ethnography, and Dr. H. Obermaier, privat-docent in prehistory at the University of Vienna, who will be professor of geology in its relation to prehistory.

We have frequently directed attention to the numerous and excellent researches of Prof. H. Breuil upon the pictorial and glyptic art of Palæolithic man. Dr. H. Obermaier has been associated with Hoernes and Penck in Germany, and Boule, Cartailhac, Breuil, and Capitan in France; he has made a special study of glacial problems, and has investigated the Pyrenean region from this point of view. He has also published important papers on the form and stratigraphy of the older stone implements.

The professors will direct the explorations and excavations undertaken by the institute, personally or with the aid of other specialists. The results will be published as monographs, in addition to shorter articles. During the dead-season they will give assistance and instruction to students who desire to make a serious study of fossil man. Lectures on the work of the institute will be given to the general public from time to time.

The institute will eventually possess an adequate library, specimens, and instruments; and not only will it bring to a focus all existing information on the subject of human palæontology, but it will be the main centre of all future researches. The stimulation and direction which the institute will afford will soon make itself felt, and in the near future we may look forward to a considerable increase in our knowledge of the early history of mankind.